MASSACHUSETTS INSTITUTE of TECHNOLOGY
LIBRARIES

Digitized by the Internet Archive
in 2011 with funding from
Boston Library Consortium Member Libraries

http://www.archive.org/details/centralissuesinn00ecka

MIT LIBRARIES
3 9080 00756659 6

HB31
.M415
no.599

DEWEY

working paper
department
of economics

CENTRAL ISSUES IN THE NEGOTIATIONS ON LIMITING GREENHOUSE WARMING

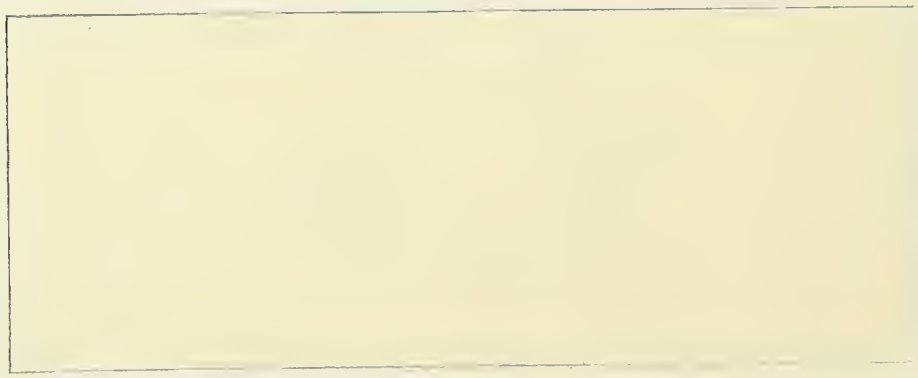
R.S. Eckaus

No. 599

12/19/91

massachusetts
institute of
technology

50 memorial drive
cambridge, mass. 02139



CENTRAL ISSUES IN THE NEGOTIATIONS ON LIMITING GREENHOUSE WARMING

R.S. Eckaus

No. 599 12/19/91

M.I.T. LIBRARIES
MAR 0 9 1992
RECEIVED

CENTRAL ISSUES IN THE NEGOTIATIONS ON LIMITING GREENHOUSE WARMING

R.S. Eckaus
Professor of Economics
Department of Economics
Center for Energy Policy Research

Massachusetts Institute of Technology

Dec. 19,1991
(revised)

The author is indebted to Charles Blitzer, Ann Friedlaender, Henry Jacoby, Paul Joskow, Richard Schmalensee and Robert Solow for helpful criticism of earlier drafts. The research on which this paper is based was supported by the Center for Energy Policy Research, MIT and The Rockefeller Foundation. Neither his critics or his supporting organizations bear any responsibility for the contents.

ABSTRACT

CENTRAL ISSUES IN THE NEGOTIATIONS ON LIMITING GREENHOUSE WARMING

The three central questions in the international negotiations on greenhouse warming are: (1) How much global warming should be tolerated? (2) How much responsibility for past emissions should be assigned to present generations? (3) How should quotas for future additions to total radiative forcing be allocated among countries? In principle, if these issues could be settled, the "command and control" procedure of regulation of the annual rate of emissions by each country, which has, so far been the focus of attention, would be unnecessary. Determination of annual rates of greenhouse gas emissions could - and should - be left to individual countries. Sales or leases of emissions "permits" among countries may be used to reallocate emissions rights.

The international negotiations may be thought as a means of asserting international control of the characteristic atmospheric responses to greenhouse gas accumulations. However, since compliance cannot be assured, when the gains from noncompliance are thought to be quite large and when violations would, in and of themselves, impose very little in the way of penalties on the violators, monitoring and coercion will be necessary to enforce any agreements.

R.S. Eckaus
Dec. 19,1991
(revised)

CENTRAL ISSUES IN THE NEGOTIATIONS ON LIMITING GREENHOUSE WARMING

I. Introduction

There is a fast time track for international negotiations on global warming policies. The United Nations International Negotiating Committee is holding regular sessions to produce a treaty on global warming issues. Simultaneously, the United Nations Commission on the Environment and Development is preparing for its conference in Rio de Janeiro in June, 1992 with an agreement on limiting greenhouse gas emissions as one of its goals.

The rationale for this quick march is that, "something must be done quickly," about the potential for greenhouse warming. With respect to the central feature of such an international agreement, it seems simply to have been assumed that the issue to be negotiated is the rate at which emissions should be reduced.

Yet it is not the rate of emissions reductions which is the fundamental problem in the international control of global warming. That problem is the management of the atmospheric stock of greenhouse gases that forces global warming. Control of emissions rates is not an end in itself, but, rather, the major instrument of regulating that stock. Thus, there are two other issues which are logically and practically prior to decisions on rates of emissions. The first issue is what amount of global warming should be tolerated and, therefore, what total atmo-

spheric stock of greenhouse gases should be allowed in the atmosphere. The second issue is the division among countries of the rights to contribute to that target stock of greenhouse gases. In principle, if these issues could be settled, the rates of greenhouse gas emissions could - and should - be left to individual countries to decide.

Even if an international agreement were confined to setting limits on the rates of emissions of greenhouse gases it would, implicitly, if not explicitly, determine the levels and rates of growth of the total atmospheric stocks of greenhouse gases. These stocks would, in turn, determine the amount of radiative forcing and global warming. If the decision remains implicit, because of confusion or avoidance of the essential issues, it will contribute to the uncertainty about the ultimate global warming effects. In addition questions of international equity and economic efficiency will also remain implicit. These issues are too pressing to be avoided, however. In particular, the self-interests of the developing nations, where the economic burdens of adjustment would be most onerous, can be expected to elicit these questions. Thus, in one form or another, they will have to be confronted.

These propositions will be explained and argued below. The issue will then be explored as to whether a rational, politically acceptable and, therefore, viable international agreement on greenhouse warming is now feasible, given the state of our scientific and economic knowledge.

II. A brief review of the state of knowledge about greenhouse warming and its consequences

Greenhouse warming is the result of the absorption by the greenhouse gases of the thermal radiation emitted by the earth, warmed by the sun. This heat, in turn, is reflected both upward and downward. The downward emissions, which further warm the earth, create the greenhouse effect. The threat arises from the accumulating anthropogenic emissions of greenhouse gases, of which carbon dioxide, methane, nitrous oxide and chlorofluorcarbons, are the most important, although recent research has created some doubt as to the net warming effect of chlorofluorcarbons.

Current emissions add to the total stock of greenhouse gases and the decay or absorption of those gases reduces the stocks. The radiative forcing effects of the atmospheric stock of greenhouse gases interact with the response characteristics of the atmosphere, the oceans, and characteristics of the earth's soil and biomass. These interactions determine the actual temperature increases and other climatic changes that would result from global warming.

While these fundamentals of greenhouse warming processes are well known, aspects that are too important to be called, "mere details," remain uncertain. There seems to be general agreement on the radiative forcing effects of the different gases in their pure forms, but there are many unresolved questions as to what happens to these gases in the atmosphere, how they interact with other atmospheric gases and even, for example, how long they per-

sist. There is, for example, a major discrepancy between estimates of the amounts of carbon dioxide generated and the amounts that can be accounted for in the atmosphere.[1] The interactions between global warming and cloud cover have yet to be worked out in a fully satisfactory manner. In addition, the role of the ocean and the role of land masses, in absorbing carbon dioxide and in regulating heat changes, are also not fully understood.[2]

The effects of global warming on regional climates, precipitation, soil moisture and sea levels are also unsure. Thus the economic and other social consequences of significant warming are unclear, in part also because of inadequacies in economic data and analysis.

While there are a growing number of studies of the economic costs of reducing greenhouse gas emissions, these have not yet converged.[3] There are studies that claim a great deal can be achieved at relatively small cost, for example, by improvements in efficiency in the use of fuels, with the net result of fewer emissions and improved economic performance.[4] And there are results that indicate the costs of adjustment to much lower emissions rates will be quite large, at least for developing countries.[5]

III. The logic of decision making on global warming

Rational decision making on global warming requires knowledge of its processes, its consequences and of the costs of avoiding such warming. How can policies be made without this knowledge being reasonably certain?

Even without complete information it is reasonable, when there is a possibility of significant losses resulting from a continuation of current practices, to change those practices. It is rather analogous to a decision to put a better lock on the door, when the newspaper announces a danger of a crime wave, although the chances of a burglar coming through the front entrance are small. In effect, the occupants of the house would make a current expenditure that reduces the probability of future losses.[6] Of course, some people would want to surround the house with watchmen, while others would shrug off the dangers.

There is no "correct" price on the option of reducing greenhouse warming effects. Each country, each person, may have a different assessment of the relative costs of such warming and the relative benefits of ameliorating the risks, with these estimates reflecting not only the uncertainties, but the countries' and individuals' current economic circumstances. When many people live in the house threatened by crime, it is reasonable that the decision should reflect the views of all of them. This joint decision making corresponds to the process now underway in the various United Nations commissions in which countries try to arrive at generally acceptable decisions.

Suppose some overall goals with respect to global warming could be decided upon. The next question is: what is it that should be controlled to limit future losses from greenhouse warming? The cursory review above of the science of global warming indicates that it must be the additional radiative forcing gener-

ated by the increases in the atmospheric stocks of greenhouse gases over some future period. So it is these increments in stocks, decided upon as if buying an option on future climate conditions, that must be controlled. While setting limits on the annual rate of emissions would do that, annual limits are excessively constraining and not necessary to achieve the goal. What is necessary is that the cumulated amounts of emissions over a period of time be constrained. That would also limit total additional radiative forcing generated by greenhouse gas emissions over a period of time and yet leave some flexibility with respect to the annual rate of emissions.

The final step in the decision process should be the allocation of those net additions to radiative forcing among countries. Once these allocations were made, individual countries could decide how and at what rate to use the allocations. That would permit each country to make its own decisions as to how it would distribute over time the economic costs of foregone output and income that are a consequences of substantial reductions in emissions.

An essential step in the allocation process is the resolution of the issue as to whether there should be debits for past greenhouse gas emissions that still contribute to radiative forcing. It might be argued that, "bygones are bygones," and, thus, that every country should stand on an equal basis (somehow defined) in the approaching international negotiations. Yet, the poor countries of the world can hardly be expected to accept the

notion that the past does not count in deciding on future emissions quotas. The current threat of global warming is certainly mainly due to the emissions generated by the industrialization and deforestation in the northern hemisphere. The industrialized countries are benefiting from their past actions that have, in effect, appropriated part of the atmospheric carrying capacity. In this relevant sense, bygones are not bygones.

If the issue of debits for previous emissions is settled, attention can be turned to rules for allocation of the target levels of radiative forcing and it will not be easy to come to agreement on such rules. Perhaps the first idea that suggests itself is that the distribution of the target levels of radiative forcing should be in terms of current population. In general, the developing countries would like this rule, because they are relatively populous, though poor. If accepted, the resulting distribution would most quickly become a limiting constraint on the already industrialized nations of the world. As a result it could be expected that they would put forward all kinds of opposing arguments, some of which would not be entirely self-serving.

The richer countries might argue that they should not be penalized by the fact that, due to the process of growth, itself, or, as a result of their culture and morés, they had limited their population growth rates, while the poorer countries had not. They might also argue that their advancement has and will contribute indirectly and directly to the advancement of the poorer countries. There are senses in which that is true, but,

on second thought, considering the reactions that might be provoked from previous colonies, perhaps the more judicious decision would be to avoid the proposition.

Some might also argue that future generations should be considered in any distribution of quotas for radiative forcing. It is, after all, not so difficult to make reasonably good population projections. The argument would certainly be opposed on the grounds that it encouraged population growth. Other principles might also be advanced, for example, that already achieved standards of living should be preserved or that growth rates not impeded.

Economists, while they have no special claim to be able to set equitable rules, should consider whether there are any Pareto optimal allocations, i.e., allocations that will make at least one country better off, without making any worse off. It must be the case that some decision on an allocation is better than none at all, which could result in global warming for all. There is a relevant theorem, named after Prof. Ronald Coase of Chicago University, who enunciated it in a famous article, which deals with adjustments to externalities. These are economic influences not mediated by markets and which, therefore, include common properties.[7] Addressed to the present issue the theorem would say that economic efficiency can be achieved whatever the distribution of, "rights" to the global radiative forcing.

The theorem lacks relevance for two reasons. First, it does not address issues of distributional equity. There can be no

doubt that different allocations of emissions quotas would impose different burdens of social and economic adjustment. Perhaps those differences could be submerged in general euphoria over, "doing something about the environment," but it is doubtful.

Second, the theorem requires the existence of perfect, or anyway pretty good markets in order for all the correct evaluations to be made. Yet, if markets, including international markets for goods and finance, were perfect, there would be quite different patterns of development than we now observe.

Thus, there will be no easy answers or answers based on universally accepted principles to the quota allocation problems. Like all distributional issues, the allocation of shares in radiative forcing is intrinsically difficult, all the more so because, in this case it involves the national interests of countries and, therefore, power, as well as equity.

This focus on the acceptable levels of radiative forcing and the allocations of shares in that target contrasts with the terms of the current analysis and debate and international negotiations. These are, virtually without exception, carried on in terms of rates of emissions of greenhouse gases, what they have been and by how much they should be reduced to preserve the global environment. For example, in the February meeting of the International Negotiating Committee of the United Nations, Working Group I was established to, "deal ... with commitments for limiting and reducing greenhouse gas emissions."[8] That is not inconsistent with dealing with the central issue of apportioning

among countries rights to use the global commons of atmospheric carrying capacity. But it is the second step toward an international policy, not the first.

Restricting the analysis only to atmospheric reactions, it might be thought that there is some simple relationship, embodying the equations of atmospheric science, between restrictions on greenhouse gas emissions and restrictions on the aggregate radiative forcing of such emissions over time. If there were such a relation, it would permit the conclusion that the one type of restriction could be transformed into the other.

It is true that there is, in principle, a relation between the current rates of emissions and increments in the future atmospheric stocks of greenhouse gases that can be translated into aggregate radiative forcing, but it is not well understood at this time and surely not simple one. It would involve the careful cumulation of the past emissions of each gas and keeping track of their rates of decay and absorption and interactions with other gases. Then, the incremental effect on future radiative forcing of the current rate of emissions might be calculated. Of course, adding oceanic and earth absorption and reaction properties will complicate matters enormously.

There is also no simple relation between economic activity, the emissions of greenhouse gases and the contribution to overall radiative forcing, since there are many potential choices among types of products, fuels and technologies that generate emissions. There is, moreover, no reason to expect that the rela-

tionships would be the same for every country. Thus, each country, given its total share of global radiative forcing could be expected to make somewhat different choices of its own rate of usage or annual emissions rate.

IV. Radiative forcing, global carrying capacity and the global commons

The logic of global warming policy decisions and the uncertainties involved are concealed by the vocabulary that has come into use. In an abbreviated and somewhat misleading terminology, the thermal response characteristics are frequently described as the "global carrying capacity" of the earth and its atmosphere. The term is misleading because it suggests that there only a specific amount of greenhouse gases that can be "carried" or tolerated. In fact, different amounts of atmospheric greenhouse gases having different consequences for global warming, at any point in time and over time and for different places on the globe. Thus, there is no single "capacity" for greenhouse gases, but rather a set of varying responses to different amounts of such gases.

In an even more misleading terminology, the response characteristics are also called the "global commons". The response characteristics of the earth and atmosphere to radiative forcing are not common property at all, in the conventional sense of "property". Common property lies between the extremes of individual ownership and control, on the one hand, and an asset or feature which belongs to and is controlled by no one. Histori-

cally, "common" property has been owned and controlled by a specific group, with the rights of the group, as a whole, and of the individuals using the property being more or less clearly defined. By comparison, ownership and control of the atmosphere is not now located with any group. So it is neither common nor private property. However, the international negotiations on climate change can be regarded as an attempt by the world community to convert the global response characteristics for greenhouse gases into a common property, in the sense that rules would be set for their use.

The benefits of common property may be more or less unlimited or finite and "subtractive", so that the greater the use by one, the less available for others. The latter have been called, "common pool," resources.[9] The same resource may even move from one category to the other, depending on the intensity of its use. That is true, for example, of waterways and highways, for which, at low utilization intensities, an additional user? will hardly reduce the benefits obtained by other users. At higher use intensities there will be congestion and degradation. There is a similar phenomenon with respect to the atmospheric, biosphere and oceans, which provide benefits as convenient dumps for greenhouse gases. These have natural regenerative capabilities, beyond which greenhouse gases accumulate with potential global warming effects.

Even if there is a United Nations treaty on global warming and the global response characteristics are appropriated as com-

mon property by the countries of the world, that does not mean that its benefits will be distributed equally or equitably. First of all, the distribution of benefits may have no connection or only a loose connection with the locus of control, but, rather, depend on the intrinsic nature of the commons. For example, the warming rays of the sun in winter do not fall equally on each side of the mountain. Secondly, the distributional differences may stem from the need for complimentary inputs in order to realize the benefits. Farmers with more cows to put on the village common lands would get a larger share of the pasture than smaller farmers. Analogously, the different economic conditions of the various countries profoundly influence their greenhouse gas emissions, the consequences of global warming for them and their costs of adjustments to it.

Adopting distinctions from the law, distributional differences due to intrinsic features may be called, "structural disparities " and those having other sources, "subjective disparities." The latter would include differences related to income and wealth, although there may be objection to the use of the word, "subjective," to describe effects ascribed to the "impersonal operation of the economic system." Of course, anyone with the resources can buy more cows. However, economic and social systems, not natural systems, determine who has the most cows.

Structural disparities in the effects of greenhouse warming can be expected to be important in creating different national

interests in constraining greenhouse gas emissions. For example, the IPCC report, Climate Change, presents the predictions of three global climate change models of the global distribution of air temperature changes, precipitation changes and soil moisture changes that would occur if there were a doubling of carbon dioxide in the atmosphere.[10] All of the predictions are made with recognition of their uncertainty, However, all of the models project much larger changes in temperature in the higher northern and southern latitudes than in a wide belt around the world than encompasses most of the developing countries of the world. With somewhat less uniformity, the same is true of projections of soil moisture and, with even less uniformity, of precipitation. There are other potential changes that might offset these, still uncertain results. They make the point, however, that there are scientific reasons for believing that the climatic impact of greenhouse warming would be quite uneven around the globe.

V. Alternative means of managing global climate change

The international negotiations on climate change are, or should be, about management of the use of the global response characteristics with respect to greenhouse gases. So management questions should be considered explicitly. As with other pollution control issues, there are two alternative approaches that can be mixed in various ways: regulatory procedures, sometimes called in the U.S. "command and control", and reliance on markets. In the present context, the alternatives are either the

regulation of the annual rate of emissions by each country or the allocation to each country of a share in the target total radiative forcing, leaving to each country the decision with respect to its use, including the possibility of leasing or selling part of its share, or some mix of the two different approaches.

The allocation to individual countries of shares in the target level of the atmospheric stocks of greenhouse gases is the analogy to the privatization of common lands. This is attractive because the "problem of the commons' is generally presumed to arise because the scarce resource, belonging to all, is treated by individuals, acting separately and seeking to maximize their own returns, as if it were available without limits and free. As a result there is inefficient overuse of the resource. That was the, "tragedy of the commons," to which Hardin made reference in his celebrated paper.[11]

Privatization is the remedy conventionally prescribed for inefficient over utilization of common property, with reliance on individual decision making and market forces to create efficiency in the use of the resource. The consequences of privatization of common lands depend, therefore, on market conditions and, as well, on the degree of inequality in the distribution of the lands. Efficiency does not necessarily march hand-in-hand with equity. The enclosures of the village commons in England, starting in the 12th century, have been the subject of many harsh criticisms for its disparate welfare consequences.

The analogy is not exact for two reasons. First, countries are not entities that manage their own resources to maximize

profits. The second reason is the fact that there are no natural boundaries that divide shares in a target level of atmospheric stocks of greenhouse gases. Unlike land usage, the appropriation of the resource by individual countries cannot be easily observed. Still countries do make decisions that affect the use of resources in their boundaries and assume responsibilities for many aspects of their environment because of its public goods features.

"Command and control", the alternative management device is an agreement to control the annual rates of emissions by each country, which is analogous to collective management of a commons. If this is to be done in an equitable manner,it is necessary to take into account the differences among countries in their histories of emissions, their current economic resources and their prospective futures. The differences in current income levels among countries and past emissions will have to be taken into account in determining the allowable future rates of emissions of greenhouse gases. There is also widely varying dependence on fuels with different distributions of greenhouse gas emissions. For example, Egypt, with a lower per capita income, uses relatively more natural gas, a "cleaner" fuel, than do Turkey and the U.S..

It might be argued that the international negotiations that focus simply on reductions in the current rate of greenhouse gas emissions would take into account all these physical and economic conditions, including the differences among countries. In order

to do that in a carefully discriminating manner, however, the negotiators would, themselves, have to do what the individual countries would do if given their share of the target radiative forcing: work out the intricate relationships between the economic conditions and growth prospects for each country and rates of greenhouse gas emissions. There is no escape from those linkages. Even if the international negotiators were successful in making the linkages, presumably the individual countries would not want to leave the choice of their rate of economic growth to an international conference. In fact, it is difficult to believe that they will knowingly surrender this aspect of their sovereignty in a United Nations treaty. It is possible that for lack of understanding, they may sign a treaty restricting their emissions rates, but they will be tempted to avoid its restrictions when they discover alternatives to their commitments.

The more users there are of a commons, implying a greater variance of fuel sources, economic conditions and opinions, the more difficult it can be expected to be to gain consensus. Some countries can be expected to want to conduct, "business as usual," i.e., to more or less continue their present practices. It is not necessarily so, but it seems plausible that, in general, poorer countries are less likely to want additional constraints on their economic development than already exist. They will be more concerned about raising their current levels of living than about uncertain and distant future damages from greenhouse warming.

Even if agreement, in some diplomatic sense, is achieved, that will not guarantee compliance. That cannot be assured where the gains from noncompliance are thought to be quite large. The problem of achieving compliance would not arise because violation of an agreement would give an advantage over another country, but for other reasons. For poor countries, the benefits of violation of international agreements, in terms of increased short term growth may be regarded as outweighing the longer term harm in larger contributions to radiative forcing. For small emitters violation of an international agreement to limit emissions will hardly affect the final outcome in terms of the accumulation of greenhouse gas emissions. Thus violations would, in and of themselves, impose very little in the way of penalties on the violators through additional global warming. This expected behavior is a version of the "free rider" problem, well-known in economics. For countries that are large and poor, violations may lead to discernible differences in greenhouse gas accumulations.[12]

With these expectations of noncompliance, monitoring and coercion will be necessary to enforce any agreements. Robert Wade in his discussion of the skepticism of Mancur Olson on collective action to manage common assets[13] comments on this point:

> Where Olson and other pessimists about collective action are surely right is in the need for coercion to back up agreements. Their emphasis on the difficulties of

> voluntary collective action is a useful counter to the simple optimism of those who believe that community development projects, people's participation, water users' associations, and the like are mainly a matter of teaching people about their real common interests or promoting values that are less individualistic.[14]

This can expected to be true on an international scale as well.

Monitoring of some of the major sources of emissions, would not be as difficult a task as monitoring of nuclear missiles, for nearly every source must be out in the open. Domestic production and international trade statistics will provide essential information on country fuel balances, which will indicate sources of greenhouse gas emissions. One can also imagine orbiting satellites and a cadre of analysts counting acres of paddy and thermal electric stations. However, monitoring will, in turn, raise many thorny issues.

Although every country generates greenhouse gases, there are important differences in scale between a few really large users and most of the rest of the countries of the world. Thus, it might be argued that the monitoring and enforcement problems could be confined only to these few large countries. On the other hand, for the purposes of international equity and domestic public support, the large countries will want to reduce the prevalence of "free riding" on the part of smaller countries.

It is not necessary to dwell on the instruments that could be used to enforce a global warming agreement. There is now considerable experience with international enforcement. However the invocation of coercive instruments would certainly require prior international monitoring.

It has also been suggested that there might be sales or leases of emissions "rights" among countries. Developing countries can be expected to have some unused quota which they could sell or lease. Industrialized countries wanting to avoid drastic adjustments brought on by sharp reductions in emissions would be on the buying or renting side. The terms on which the emissions rights exchange would depend on the particular type of emission and the demand and supply conditions. For example, methane's atmospheric lifetime has been estimated at about 12 years and carbon dioxide's at 100 to 200 years.[15] An industrialized country using a relatively large amount of natural gas, whose production and use releases methane into the atmosphere might want to make a deal for a quota for methane emissions. A country more dependent on coal and petroleum might propose deals on carbon monoxide emissions.[16]

Both developing and industrialized countries will have to evaluate the value to them of such leases or sales of quotas. That would also require the same kind of careful scientific/economic assessment that would be undertaken if each country were granted a share of the global carrying capacity.

VIII. What can be negotiated?

A plausible reaction to the arguments above would be that it is much less difficult to negotiate restrictions on rates of greenhouse gas emissions than it is to negotiate shares in total radiative forcing. The latter, as argued above, requires facing up to three difficult questions: (1) How much global warming should be tolerated? (2) How much responsibility for past emissions should be assigned to present generations? (3) How should quotas for future additions to total radiative forcing be allocated?

By comparison, a limitation on the current rate of emissions seems to avoid all of these questions. Of course it does that only by ignoring the fundamental issues. No doubt, there are instances in which apparent diplomatic progress is made by avoiding confrontation with root problems and concentrating on subsidiary subjects. There may, however, be just as many examples in which this approach has only stored up trouble for the future.

The Montreal protocol on chlorofluorcarbons, often cited as a precedent for an agreement on greenhouse gas emissions is really not helpful. The scientific basis for policy and, therefore,the goals of policy were driven by the overwhelming scientific evidence and relatively clear cut predictions of the pressing consequences for stratospheric ozone depletion of continued emissions of CFC's. In addition, though not without costs, the virtual elimination of CFC's will not impose economic burdens of anywhere near the magnitude of those associated with significant reductions in greenhouse gas emissions.

It is often alleged that the impetus in Europe for agreement on greenhouse gas emissions restrictions is the result of the political importance of the "Green" parties. The conventional parties, by agreeing to emissions restrictions, can hope to salvage the global environmental issue for themselves.

Where internal politics is not compelling, it can be expected that some countries will opt to delay agreements until the gains and losses can be determined with more accuracy than is now possible. This, apparently, has been the U.S. position. The pressure on the U.S. is growing, however, and it will face the temptation to make some concessions, as long as those are "off budget", i.e. do not require additional federal expenditures. There are a number of such possibilities. Massachusetts, which has its own global environment policy, requires electrical generating utilities to take actions to reduce greenhouse gas emissions that result in higher electric bills for consumers. Similarly, there could be U.S. programs requiring changes in the mix of fuels or mandating increased reliance on thermoelectric sources, that would also result in higher electricity bills, but would not affect the federal budget.

With modest and specialized exceptions, the Green movements in the developing countries have relatively little political influence. For this reason, as well as on economic grounds, it would be natural, therefore, for developing countries also to delay agreement. In such circumstances, they will have to be "bought out" or threatened by the industrialized countries that want to restrict emissions.

Fortunately, the negotiations are not a zero sum game. If the global warming phenomenon is real, all countries will stand to gain from arriving at an agreement, although to different degrees. As in other negotiations of this sort, the final agreement will be a compromise with variability in the extent of the gains.

Of course, the industrialized countries have a number of instruments that they can use to achieve agreement. For example, the campaign, already started, to tie environmental agreements to access to trade and finance, including funds from the IMF and World Bank, can be expected to intensify. Another instrument is payments by industrialized countries to developing countries to reduce emissions. These could take a number of different forms. Other than straight money transfers, the industrialized countries could supply non polluting energy technologies to replace the intensive use of coal in thermoelectric generating stations. Or the industrialized countries could subsidize the use of wood substitutes themselves and in developing countries to help preserve the latters' forests.

VI. What can be expected from the planned negotiations?

The public discussions to date of an international agreement on global warming have the quality cited in the Wade quotation above, that all that is necessary is, "teaching people about their real common interests or promoting values that are less individualistic." However, the arguments made here lead to the conclusion that very difficult scientific, political and economic

issues are involved. The negotiations are not "simply" about the rate of greenhouse gas emissions, but inevitably impact on central features of every country's life, and include some influence on the distribution of the world's income and wealth. Moreover, monitoring and coercion will be required to enforce agreements. This is quite a different agenda than is now before the International Negotiating Committee.

There are grand issues at stake, with environmental and economic development questions closely intertwined. The international negotiations will be a success if they only contribute to a better understanding of these issues.

FOOTNOTES

1 See Intergovernmental Panel on Climate Change (1990), p.13.

2 Although the "Policymakers Summary of the IPCC report is rather unequivocal in warning of imminent dangers of global warming, the various separate studies indicate much more scientific uncertainty about the processes involved. See, ibid., vii-xxiv.

3 William D. Nordhaus (1991) provides a useful, though partial, survey.

4 See Committee on Science, Engineering and Public Policy, National Academy of Sciences, (1991).

5 Blitzer, et al, (1990).

6 In a somewhat more formal terminology, it is reasonable to buy an option that offsets future costs or provides for participation in future gains, even when those future eventualities are uncertain. It is possible to provide estimates of the values of such options when the values of future events and their probabilities are knowable.

7 Coase, R. (1960)

8 UN Chronicle, XXVIII, (2) June, 1991, p. 57.

9 Cited in W. Blomquist and E. Ostron, (199?)

10 See J.F.B. Mitchell, S. Manabe, T. Tokioka and V. Meleshko, (1990)

11 Even this does not necessarily imply the destruction of the commons," as Hardin and others have argued. That outcome depends on the physical characteristics of the commons, as well as conditions in markets for the outputs and other inputs. Cf. G. Hardin, (1962).

12 There are various simple games that can be constructed to illustrate the point in which rich and poor and large and small countries "play" against each other. It is important to note in constructing these games that the greenhouse gas emissions of large and small countries and rich and poor countries will be of quite different magnitudes and, or, have different potential payoffs. They, will, therefore, have different consequences for eventual greenhouse warming.

13 M. Olson, (1971).

14 op.cit., p. 229.

15 IPCC (1990), p. 60.

16 One attempt to define relatively simple physical concept that could be the basis for trade in emissions rights is that of Lashoff and Ahuja, (1989). Such attempts are bound to fail as there can be no purely physical index of the economic consequences of greenhouse gas emissions. If these emissions become binding economic constraints, they will, in general, impose different economic opportunity costs in different periods as well as in different countries. See Eckaus (1990).

BIBLIOGRAPHY

Blitzer, C.R., Eckaus, R.S., Lahiri, S. and Meeraus, A., "A General Equilibrium Analysis of the Effects of Carbon Emissions Restrictions on Economic Growth in a Developing Country," MIT Department of Economics Working Paper, No. 558, June, 1990.

Blomquist, W. and Ostron, E. "Institutional Capacity and the Resolution of a Commons Dilemma," Policy Studies Review, 5, (2), 283-293.

Coase, R., "The Problem of Social Cost," Journal of Law and Economics, 3(1), Oct., 1960, 1-44.

Committee on Science, Engineering and Public Policy, National Academy of Sciences, et al, Policy Implications of Greenhouse Warming, National Academy Press, Washington, D.C., 1991.

Eckaus, R.S., "Comparing the Effects of Greenhouse Gas Emissions on Global Warming," Center for Energy Policy Research, MIT, 1991.

G. Hardin, "The Tragedy of the Commons," Science, 162, 1243-8

Intergovernmental Panel on Climate Change, Climate Change: The IPCC Scientific Assessment, ed. J.T. Houghton, G.J. Jenkins and J.J. Ephraums, Cambridge U. Press, Cambridge, 1990.

Lashoff, D.A. and Ahuja, D.R., "Relative Contributions of Greenhouse Gas Emissions to Global Warming," Nature, 344, 5 April, 1990, 529-531.

Mitchell, J.F.B., Manabe, S., Tokioka, T. and Meleshko, V. "Equilibrium Climate Change," in J. T. Houghton, G.J. Jenkins and J.J. Ephraums, Climate Change, Cambridge U. Press, N.Y., 1990, pp. 131-1782.

Nordhaus, William D., "The Cost of Slowing Climate Change: A Survey," Energy Journal, 12(1), 1991.

Olson, M., The Logic of Collective Action, Harvard U. Press, Cambridge, Ma., 1971.

3858 181

DEWEY

Date Due 9-8-92

DEC. 26 1992

AUG. 3 [illegible]

Lib-26-67

MIT LIBRARIES DUPL

3 9080 00756659 6